

TIMOTHY J. SULLIVAN, Ph.D., 4-7-09

IN THE UNITED STATES DISTRICT COURT FOR THE  
NORTHERN DISTRICT OF OKLAHOMA

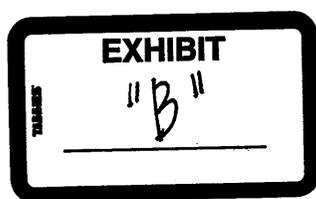
W. A. DREW EDMONDSON, in his )	
capacity as ATTORNEY GENERAL )	
OF THE STATE OF OKLAHOMA and )	09:03:25
OKLAHOMA SECRETARY OF THE )	09:03:25
ENVIRONMENT C. MILES TOLBERT,) )	
in his capacity as the )	
TRUSTEE FOR NATURAL RESOURCES) )	
FOR THE STATE OF OKLAHOMA, )	
)	
Plaintiff, )	
)	
vs. )	4:05-CV-00329-TCK-SAJ
)	
TYSON FOODS, INC., et al, )	09:03:25
)	09:03:25
)	
Defendants. )	

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VOLUME I VIDEOTAPED DEPOSITION OF TIMOTHY J.	09:03:25
SULLIVAN, Ph.D., produced as a witness on behalf of	09:03:25
the Plaintiffs in the above styled and numbered	
cause, taken on the 7th day of April, 2009, in the	
City of Tulsa, County of Tulsa, State of Oklahoma,	
before me, Karla E. Barrow, a Certified Shorthand	09:03:25
Reporter, duly certified under and by virtue of the	09:03:25
laws of the State of Oklahoma.	

09:03:25  
09:03:25

TULSA FREELANCE REPORTERS  
918-587-2878





TIMOTHY J. SULLIVAN, Ph.D., 4-7-09

1 think of at the moment that we did on that farm, but  
 2 that was in the Tillamook watershed.  
 3 Q When you say stressors, are you referring to  
 4 sources of fecal coliform bacteria?  
 5 A Well, in an aquatic system, there can be many 02:09:08  
 6 stressors, and we looked at -- we looked at most or  
 7 all of them, is my guess, depending on the data that  
 8 we had and the issues that were thought to be most  
 9 important in that -- in that watershed. So the  
 10 stressors would include fecal indicator bacteria, 02:09:18  
 11 fecal coliforms, E. coli, where they were available,  
 12 although I don't think that we used any E. coli in  
 13 the Tillamook ones, we did in some other watersheds.  
 14 Temperature is an important stressor. Availability  
 15 of shade, nutrients, nitrogen and phosphorus, 02:09:29  
 16 sediment and flux. I think those would be the main  
 17 ones.  
 18 Q I was trying to determine when you say that  
 19 you identified stressors in the watershed and  
 20 evaluated water quality parameters, I was just 02:10:13  
 21 trying to make a distinction between those two  
 22 things in my mind. Water quality parameters, what  
 23 do you mean by that?  
 24 A The various indicator bacteria, nitrogen,  
 25 phosphorus, pH, water temperature, those are all 02:10:22

134

1 parameters that were looked at. Again, depending on  
 2 the data availability.  
 3 Q Did you identify any sources of fecal coliform  
 4 bacteria in the Wilson, Kilchis and Miami  
 5 watersheds? 02:11:05  
 6 A Did I identify specific sources?  
 7 Q Yes.  
 8 A Is that my answer, or is that -- sorry. It  
 9 was back to the same issue is that with the kinds of  
 10 spatial analyses that we're doing, we were not able 02:11:14  
 11 to be explicit in most cases. There was one  
 12 exception to that, and I feel like we demonstrated  
 13 that, but I suppose that's a little bit, you know,  
 14 up to question, as well, but there was a fairly  
 15 significant increase in bacteria immediately 02:11:24  
 16 downstream from the effluent pipe from the creamery,  
 17 that my interpretation of that is that it was not a  
 18 fecal origin, but there were bacteria that come out  
 19 as being classified as fecal coliforms on the lab  
 20 procedures that sometimes is not necessarily a fecal 02:12:04  
 21 origin. I think this is one example where that was  
 22 the case. But I wouldn't say that we provided  
 23 overwhelming evidence that the bacteria were coming  
 24 from the creamery effluent pipe, but I was convinced  
 25 that they were. 02:12:14

135

1 Q I think you might be relieved to hear that I'm  
 2 not going to ask any more questions about the  
 3 Tillamook watershed for a little while.  
 4 A I like the Tillamook. We can talk about that  
 5 some more, if you want. 02:12:22  
 6 Q Okay, I think we will, but I'm back on one  
 7 point of your expert report, which is your resume,  
 8 talking about your expertise. What is nitrogen  
 9 cycling?  
 10 A Well, it's movement of nitrogen within the 02:12:32  
 11 ecosystem cycling through different compartments,  
 12 atmosphere, soil, water, vegetation.  
 13 Q Are you -- is it within your area of expertise  
 14 to evaluate the eutrophication impacts of  
 15 nitrogen -- 02:13:13  
 16 A Yes.  
 17 Q -- in the environment?  
 18 A Yes.  
 19 Q Does that include eutrophication of lakes?  
 20 A It can. 02:13:19  
 21 Q In what cases have you evaluated  
 22 eutrophication of lakes?  
 23 A I discussed that at some length in -- in the  
 24 assessment report that I wrote for EPA that was  
 25 published in December of 2008, although I just found 02:14:01

136

1 out last week that it actually was released then,  
 2 and it may not be in my resume or listed as an  
 3 actual -- it won't be listed as a 2008 publication  
 4 because I didn't know it was actually published  
 5 until last week, but that was an evaluation that I 02:14:09  
 6 had the technical lead on. I had a team of about  
 7 eight or 10, I guess, different scientists from  
 8 around the country, and we were evaluating the  
 9 what's called the secondary effects, that means the  
 10 environmental effects of oxidized nitrogen and 02:14:19  
 11 oxidized sulfur on natural resources in the United  
 12 States as influenced by atmospheric contributions of  
 13 nitrogen and sulfur oxides. So it was part of the  
 14 National Ambient Air Quality Standards evaluation  
 15 procedure that EPA go through periodically, and my 02:14:28  
 16 company was hired to take the lead on performing  
 17 that, and we wrote about a 1,200 page report to  
 18 summarize that information, and then passed it over  
 19 to EPA, and they worked with it and finalized it and  
 20 published it as an EPA report. So there was a 02:15:08  
 21 fairly substantial discussion of nitrogen  
 22 eutrophication issues of lakes in that report.  
 23 Q Did you write that part, that section of the  
 24 report?  
 25 A I wrote -- I rewrote the whole thing, but in 02:15:15

137

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TIMOTHY J. SULLIVAN, Ph.D., 4-7-09

1 terms of the initial -- the initial writing, I would  
 2 say that I wrote parts of that, and two other  
 3 scientists wrote other parts of that.  
 4 **Q Did you work with a limnologist on the**  
 5 **drafting of that section of the report?** 02:15:24  
 6 A Well, I mean, a lot of the people that I work  
 7 with, including myself, we're more multidisciplinary  
 8 environmental scientists rather than pigeonholed as  
 9 a limnologist. I don't know that there's anybody in  
 10 the group that we necessarily would say is 02:16:03  
 11 specifically a limnologist, but a large number of  
 12 the authors, including myself, have done a lot of  
 13 limnological research.  
 14 **Q When you were evaluating the effects of**  
 15 **nitrogen on the limnology of this lake, did you** 02:16:18  
 16 **employ the Carlson Trophic State Index for your**  
 17 **analysis?**  
 18 A I wasn't looking at one lake. I was providing  
 19 an assessment of the issue throughout the United  
 20 States, and to what extent our lakes are sensitive 02:16:28  
 21 to eutrophication from nitrogen input and where are  
 22 such lakes located. Those were the issues that we  
 23 were focusing on.  
 24 **Q And just so I understand, which lakes across**  
 25 **the country are sensitive to nitrogen impacts from** 02:17:06  
 138

1 air deposition?  
 2 A Well, that's what we were tasked to look at  
 3 because it was part of the National Ambient Air  
 4 Quality Standards evaluation process, but the lake  
 5 doesn't care where the nitrogen came from, if it 02:17:13  
 6 came from the air or came from an inflowing stream,  
 7 it's still nitrogen that's arriving in the lake. So  
 8 we were looking at -- in that report, we were  
 9 looking at the extent to which nitrogen  
 10 contributions could contribute to that 02:17:19  
 11 eutrophication process.  
 12 **Q When you were doing that, did you have to**  
 13 **identify whether the lakes were nitrogen or**  
 14 **phosphorus limited?**  
 15 A Well, that would be -- that's one of the 02:17:26  
 16 things that we discussed, that's certainly a part of  
 17 it, and if a lake is phosphorus limited, then in  
 18 general, you don't expect to see eutrophication from  
 19 addition of nitrogen. But there are some lakes that  
 20 are nitrogen limited. There are some lakes that 02:18:04  
 21 switch back and forth.  
 22 **Q Is there any other factors that you evaluated**  
 23 **in determining whether the lakes were subject to**  
 24 **eutrophication as a result of nitrogen**  
 25 **contributions?** 02:18:12  
 139

1 A I'm not following the question.  
 2 **Q What factors did you look at when identifying**  
 3 **lakes that would be impacted by atmospheric nitrogen**  
 4 **deposition?**  
 5 A We looked at published material. This 02:18:18  
 6 document was restricted to a synthesis of published  
 7 material, so we looked at the extent to which  
 8 studies had been conducted that had identified lakes  
 9 as being sensitive in terms of eutrophication to  
 10 nitrogen inputs, and what kinds of lakes they were 02:18:27  
 11 and what the conditions were whereby that would be  
 12 likely to occur.  
 13 **Q Did you do any other analysis besides that, to**  
 14 **identify which lakes would be sensitive?**  
 15 A Well, I just relied on the studies that had 02:19:05  
 16 been published to evaluate the issue. I mean, I  
 17 didn't try to take lake A and determine if it's  
 18 nitrogen limited or not.  
 19 **Q Have you ever evaluated the eutrophication**  
 20 **status of a particular lake?** 02:19:16  
 21 A I've looked at the nutrient concentrations in  
 22 a number of lakes, so beyond that, I'm not sure what  
 23 you mean.  
 24 **Q Well, have you -- have ever done any research**  
 25 **or issued any opinions regarding the trophic status** 02:19:24  
 140

1 of a particular lake?  
 2 A I don't think so. Probably not for a lake.  
 3 **Q Have you done any analysis or issued any**  
 4 **opinions with regard to the trophic status of a**  
 5 **stream?** 02:20:07  
 6 A That National Ambient Air Quality report that  
 7 I'm talking about, I don't remember if we talked  
 8 about streams with respect to this issue. I know  
 9 that at least the major focus for this issue was  
 10 lakes. There might have been some stream discussion 02:20:19  
 11 in there, too. I mean, we talked about the nutrient  
 12 status of streams and most of those watershed  
 13 assessments, and I think that there is some of them  
 14 where we looked at N versus P limitation. I know I  
 15 looked at N versus P limitation in the Tillamook 02:21:06  
 16 studies, those would be streams. I can't think of  
 17 any other.  
 18 **Q Have you ever collected any samples of algae**  
 19 **in a river or a stream?**  
 20 A A long time ago. 02:21:18  
 21 **Q What was the context of that?**  
 22 A The context of that would have been in an  
 23 educational arena, I would have collected algae with  
 24 students. I certainly did that in lakes, and I  
 25 think I did it in streams. One of the things I used 02:21:28  
 141

TIMOTHY J. SULLIVAN, Ph.D., 4-7-09

1 to do with students in streams is to collect stones  
2 from the streambed and bleach the chlorophyll out of  
3 them, and have them do a colorimetric analyses to  
4 determine the differences in the amount of  
5 chlorophyll or even evaluate it visually, different 02:22:06  
6 types of habitat and how the amount of algae on the  
7 stones in the streambed would change with shading,  
8 for example. So that was in an educational context.  
9 They're the only ones that I can think of at the  
10 moment. 02:22:17  
11 **Q Do you have any experience with blue-green**  
12 **algae?**  
13 **A** Blue-greens are present in some of the systems  
14 where we work. The main -- the main location where  
15 they're present is in the Klamath Reservoir System, 02:22:26  
16 where my company has done a lot of work for a lot of  
17 years, and I'm peripherally involved in that and  
18 have been for a number of years. So another  
19 scientist in my company devotes most of his work to  
20 that study, and we discuss the results of that 02:23:04  
21 fairly frequently, but I'm not directly analyzing  
22 those data or collecting those samples.  
23 **Q What is aquatic acid based chemistry?**  
24 **A** That's the chemistry that evaluates the  
25 balance between acids and bases, and can be in an 02:23:17

142

1 aquatic ecosystem, it can be in soil water, it can  
2 be in soil. It's the balance between the acidic  
3 components, like hydrogen and aluminum as opposed to  
4 the basic components like calcium, magnesium,  
5 potassium and sodium. 02:23:27  
6 **Q Mobilization, speciation and toxicity of**  
7 **metals in acidic waters, what causes these waters to**  
8 **be acidic that you are --**  
9 **A** Well, there are multiple causes. Deposition  
10 of acid precursors from the atmosphere, sulfur or 02:24:13  
11 nitrogen, that's one. Acid mine drainage, that's  
12 two. Geological sources of oxidized sulfur or  
13 nitrogen, that would be the third. Naturally  
14 occurring organic acids associated with high organic  
15 content, often with the wetlands influence would be 02:24:26  
16 another. Those are the ones that come to mind.  
17 **Q Do you know whether the waters of the Illinois**  
18 **River watershed are acidic?**  
19 **A** I've seen no data to suggest that they're  
20 acidic anywhere. 02:25:05  
21 **Q What is the episodic processes controlling**  
22 **surface water chemistry?**  
23 **A** That has to do with changes in the chemistry  
24 of a lake or a stream during what's called  
25 hydrological episodes, and those are episodes of 02:25:13

143

1 enhanced water movement in response to snow melt or  
2 rainstorms or both.  
3 **Q That's the episodic process is the snow melt**  
4 **or rainfall; is that correct?**  
5 **A** I'm sorry, say that again. 02:25:25  
6 **Q I'm just trying -- I'm just trying to figure**  
7 **out exactly what this means. Episodic processes**  
8 **controlling surface water chemistry.**  
9 **A** Okay.  
10 **Q Are those processes snow melt and rainfall?** 02:26:01  
11 **A** No. The episode isn't snow melt episode or  
12 rainfall episode. The processes that are influenced  
13 by that episode, with an end result being a change  
14 in the chemistry, would include changes in the  
15 residence time of the water in different components 02:26:10  
16 of the soil system, the flow pass followed by the  
17 waters through the soils, through the organic  
18 horizons versus the mineral soil versus lower  
19 mineral soil. Changes that occur in terms of  
20 interactions between the water and the stream 02:26:19  
21 sediment. So there are a number of episodic  
22 processes that occur. Flushing of materials through  
23 what's called the piston effect or otherwise  
24 flushing out of different components of the soil  
25 into the stream of various constituents, aluminum, 02:26:27

144

1 calcium, sulfate, nitrogen, so those would be some  
2 of the processes that are important in terms of  
3 evaluating episodic effects.  
4 **Q And do you have an expertise in evaluating**  
5 **these episodic processes for all chemicals?** 02:27:10  
6 **A** No, I wouldn't say all chemicals. I mean, the  
7 principals of evaluating episodic processes are -- I  
8 think are pretty transferable. I wouldn't say all.  
9 Again, in environmental science, you never say never  
10 and you never say all because you always can find an 02:27:22  
11 exception out there.  
12 **Q Which chemicals have you specifically worked**  
13 **with?**  
14 **A** In terms of episodic effects and processes?  
15 **Q** Uh-huh. 02:28:02  
16 **A** Hydrogen, aluminum, sulfur or sulfate,  
17 nitrogen or nitrate, calcium, magnesium, potassium.  
18 Did I say aluminum?  
19 **Q** You did.  
20 **A** Maybe a little bit with silica, but not 02:28:12  
21 really. Alkalinity, which is not really a chemical  
22 but it's a reflection of chemistry. Dissolved  
23 organic carbon, total organic carbon. I'm probably  
24 missing some, but I've worked with all of those.  
25 **Q What about have you worked with these -- in** 02:28:28

145

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TIMOTHY J. SULLIVAN, Ph.D., VOLUME II, 4-8-09

IN THE UNITED STATES DISTRICT COURT FOR THE  
NORTHERN DISTRICT OF OKLAHOMA

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OKLAHOMA SECRETARY OF THE )	08:43:24
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TIMOTHY J. SULLIVAN, Ph.D., VOLUME II, 4-8-09

1 the state. So this was not a comparison with the  
 2 Arkansas portion with the rest of the state because  
 3 the lawsuit, as I understand it, is a lawsuit by  
 4 Oklahoma, so I assumed that Oklahoma would be more  
 5 interested in how different or similar the fecal 09:19:09  
 6 indicator bacteria values within the IRW in Oklahoma  
 7 may be compared to the rest of the state of  
 8 Oklahoma.  
 9 **Q Why would you assume that the State would be**  
 10 **interested in that? 09:19:16**  
 11 A Well, one of the claims that was -- that came  
 12 through to me listening to the testimonies in the  
 13 preliminary injunction hearing was the claim by a  
 14 number of the consultants for the plaintiffs in this  
 15 case that the concentrations of fecal indicator 09:19:25  
 16 bacteria inside the IRW in Oklahoma were somehow  
 17 alarming, a cause for great concern. I mean  
 18 that's -- they asked for a preliminary injunction  
 19 against litter spreading because they claimed that  
 20 it was a major concern, something needed to be done 09:20:06  
 21 about it right away. So my emphasis was to  
 22 evaluate, well, are the concentrations inside the  
 23 IRW really that different from the rest of Oklahoma,  
 24 because I didn't see any presentation from the  
 25 plaintiffs' consultants in the PI hearing that would 09:20:15

282

1 suggest that they even looked at that, so I did.  
 2 **Q And why is it that you think that the bacteria**  
 3 **levels in the Arkansas part of the Illinois**  
 4 **watershed are not of interest to the State of**  
 5 **Oklahoma? 09:20:22**  
 6 A I don't know whether they're of interest to  
 7 the State of Oklahoma or not, but again, what I was  
 8 trying to do with this map was to answer, first for  
 9 my own curiosity, and secondly, to provide as a  
 10 presentation in this case an analysis that would 09:20:32  
 11 tell me are the -- Oklahoma filed the lawsuit, they  
 12 asked for a preliminary injunction partly or largely  
 13 because of bacteria. So my question was, well, are  
 14 the bacteria concentrations in the IRW in Oklahoma  
 15 of such magnitude that the State would be justified 09:21:10  
 16 in having such a level of concern, and these maps  
 17 would suggest to me the answer is no.  
 18 **Q Did you do any analysis that would compare the**  
 19 **level of bacteria in Arkansas, the Arkansas part of**  
 20 **the Illinois River watershed to levels across the 09:21:20**  
 21 **state of Oklahoma?**  
 22 A I'm sorry, can you restate that?  
 23 **Q Did you do any analysis comparing fecal**  
 24 **coliform bacteria levels in the Arkansas portion of**  
 25 **the Illinois River watershed to levels across the 09:21:28**

283

1 **state of Oklahoma?**  
 2 A Compare Arkansas to Oklahoma. I don't think I  
 3 did that. I don't remember -- I don't remember  
 4 doing that.  
 5 **Q When I look at Figure 2-8, I think we were 09:22:03**  
 6 **talking earlier about it being an analysis of the**  
 7 **Enterococcus data from USGS. To me, it appears to**  
 8 **be an analysis of fecal coliform levels and -- is**  
 9 **that correct?**  
 10 A It is an analysis of fecal coliforms, and if I 09:22:14  
 11 stated that it was Enterococcus, then I apologize.  
 12 And the USGS actually did not collect Enterococcus.  
 13 I think that there were a few samples in more recent  
 14 years, but there were -- well, for the period  
 15 analyzed here, 2000 to 2007, there were, I believe, 09:22:24  
 16 no Enterococcus data for the state of Oklahoma from  
 17 the USGS, or if there were, there were so few data  
 18 points that we were not able to some treat them out.  
 19 **Q Okay. Let's look at Figure 2-8. Is that --**  
 20 **well, let me go back. Did any of the analysis in 09:23:03**  
 21 **Figure 2-6 or 2-7 evaluate the single sample water**  
 22 **quality standard for Enterococcus?**  
 23 A I'm sorry, can you restate the question again  
 24 for those two, Enterococcus?  
 25 **Q Did any of the analysis presented on Figure 09:23:12**

284

1 **2-6 or Figure 2-7 evaluate the single sample for**  
 2 **Enterococcus as compared to the rest of the state?**  
 3 A There are analyses that evaluate that within  
 4 Oklahoma at Tahlequah in the report, but these two  
 5 figures, these two maps that you're asking about, 09:23:25  
 6 were analyses of the geomean, not analyses of the  
 7 single standard, so there are five or more samples  
 8 in each case. And to tell you the truth, I don't  
 9 remember if the Enterococcus standard is 10 percent  
 10 or a single standard. I'm not sure. But the 09:24:07  
 11 analysis here is the geomean, and thank you for  
 12 pointing out the 2-8, so what I said about  
 13 Enterococcus was incorrect, because in all cases in  
 14 this series, I go through the fecal indicator  
 15 bacteria one by one for the three different data 09:24:18  
 16 sources, but I was not able to do that with  
 17 Enterococcus with USGS because there was not the  
 18 data to do it with. And so I misspoke earlier when  
 19 I testified about Figure 2-8 when I said it was  
 20 Enterococcus, when, in fact, it was fecal coliforms. 09:24:27  
 21 **Q I don't know if it's possible to spend any**  
 22 **time on this or not, but Figures 2-8 through 2-17,**  
 23 **can you look at those and tell me whether the**  
 24 **calculations that led to the bars on those figures**  
 25 **were done any differently from the figures we just 09:25:17**

285

TIMOTHY J. SULLIVAN, Ph.D., VOLUME II, 4-8-09

<p>1 discussed, Figure 2-6 and Figure 2-7?</p> <p>2 A The calculations would have been done in the</p> <p>3 same manner.</p> <p>4 Q And by the same person?</p> <p>5 A Yes. 09:25:28</p> <p>6 Q What was that person's name again?</p> <p>7 A Todd McDonald.</p> <p>8 Q Figure 2-8, is that a calculation of geomeans</p> <p>9 for fecal coliform based on USGS data?</p> <p>10 A Figure 2-8 is geomean fecal coliforms, sites 09:26:13</p> <p>11 with five or more samples during the time period of</p> <p>12 2000 through 2007, and the months -- the days May 1</p> <p>13 through September 30th.</p> <p>14 Q And Figure 2-9 would be the calculation, the</p> <p>15 geomean fecal coliform levels based on EPA STORET 09:26:24</p> <p>16 data?</p> <p>17 A Yes, it's based on EPA STORET.</p> <p>18 Q And then Figure 2-10, that calculation of</p> <p>19 fecal coliform concentration is based on what --</p> <p>20 Oklahoma Water Resources Board data? 09:27:03</p> <p>21 A Yes, it is.</p> <p>22 Q Did you combine those figures into one figure?</p> <p>23 A Yes.</p> <p>24 Q Is that represented on Figure 2-16?</p> <p>25 A Figure 2-16 is the geomean fecal total 09:27:16</p> <p style="text-align: center;">286</p>	<p>1 A I'm sorry, which figure?</p> <p>2 Q Figure 2-16.</p> <p>3 A Figure 2-16, inside the IRW. I can see -- I</p> <p>4 can see five. There may be some behind other ones,</p> <p>5 but I can see five on the figure visually. 09:29:19</p> <p>6 Q And referring back to 2-8, I see 1, 2, 3, 4,</p> <p>7 5, 6; do you?</p> <p>8 A On Figure 2-8, I see five clearly, and I see</p> <p>9 the hint of one -- what I believe is the hint of one</p> <p>10 behind one, and that -- because the scale is 09:30:03</p> <p>11 presented on Page 2-16 with the bars being smaller,</p> <p>12 my suspicion is that it's behind it and we can't see</p> <p>13 it on 2-16, but I would have to go back and look at</p> <p>14 the individual data to confirm that.</p> <p>15 Q Okay. Figure 2-11, is that the geometric mean 09:30:17</p> <p>16 calculations for E. coli that you did based on USGS</p> <p>17 information?</p> <p>18 A Figure 2-11. Let's see. Figure 2-11 is USGS</p> <p>19 data, E. coli, the same time periods we've been</p> <p>20 talking about elsewhere. 09:31:02</p> <p>21 Q And is Figure 2-12 the geomean, the E. coli</p> <p>22 calculations that you did based on EPA STORET data?</p> <p>23 A Figure 2-12 is EPA STORET.</p> <p>24 Q And Figure 2-13, is that the calculations that</p> <p>25 you did for geomean E. coli concentrations based on 09:31:14</p> <p style="text-align: center;">288</p>
<p>1 coliforms, again, five or more samples during the</p> <p>2 same time periods, and it includes USGS, STORET and</p> <p>3 Oklahoma Water Resources Board data combined.</p> <p>4 Q In comparing that Figure 2-16 to Figure 2-8,</p> <p>5 USGS fecal coliform analysis. 09:27:32</p> <p>6 A Uh-huh.</p> <p>7 Q The bars on Figure 2-8 look much higher than</p> <p>8 the bars on 2-16. Is that -- if 2-16 includes the</p> <p>9 USGS, wouldn't the bars be the same height?</p> <p>10 A Well, they would be if the scales were the 09:28:13</p> <p>11 same. The scales on maps of this sort are adjusted</p> <p>12 to show the range of values on the map. You don't</p> <p>13 want to have bars that are so tall they go off the</p> <p>14 map, and you don't want bars that are so short that</p> <p>15 you can't see them, so you adjust the bars depending 09:28:22</p> <p>16 on the concentrations for the mix of data across the</p> <p>17 graph. That's why we provide scale bars, for that</p> <p>18 reason. And that's also a major reason why I wanted</p> <p>19 to color these green versus orange so that it would</p> <p>20 make it easier to see which sites were above versus 09:29:01</p> <p>21 below the standard value.</p> <p>22 Q It's difficult to tell for sure, but on Figure</p> <p>23 2-16, inside the Illinois River watershed, it looks</p> <p>24 like there are five points where you show</p> <p>25 exceedances of the geomean? 09:29:10</p> <p style="text-align: center;">287</p>	<p>1 the Water Resources Board data?</p> <p>2 A Figure 2-13 is Water Resources Board, E. coli.</p> <p>3 Q And were those three figures combined on any</p> <p>4 figure in your report?</p> <p>5 A Let's see. E. coli. I see E. coli from three 09:31:26</p> <p>6 data sources on Figure 2-17.</p> <p>7 Q And that -- I just want to make it clear. Is</p> <p>8 that combining the analysis from 2-11 through -- let</p> <p>9 me make sure, 2-11, 2-12 and 2-13?</p> <p>10 A That would be combining the data in 2-11, 09:32:13</p> <p>11 2-12, and 2-13, yes.</p> <p>12 Q Looking at Figure 2-17, it appears to me there</p> <p>13 are a number of exceedances of the E. coli standard</p> <p>14 throughout the Illinois River watershed. Is that</p> <p>15 the way you interpret this? 09:32:32</p> <p>16 A You're asking about 2-17?</p> <p>17 Q Yes.</p> <p>18 A There are a number of sites on Figure 2-17</p> <p>19 inside the IRW that had the geomean of the five</p> <p>20 samples during that time period that were colored as 09:33:09</p> <p>21 orange, indicating that they were above the geomean</p> <p>22 standard.</p> <p>23 Q Based on this analysis that you did, do you</p> <p>24 see widespread violations of the E. coli standard in</p> <p>25 Oklahoma? 09:33:19</p> <p style="text-align: center;">289</p>

TIMOTHY J. SULLIVAN, Ph.D., VOLUME II, 4-8-09

<p>1 A Uh-huh.</p> <p>2 <b>Q To a stream in a rainfall event or even to yet</b></p> <p>3 <b>another location?</b></p> <p>4 MR. BOND: Object to the form.</p> <p>5 A Well, that's going to depend, because if you 11:27:13</p> <p>6 start at point A and there is overland flow and it</p> <p>7 moves to point B, and then you have another storm</p> <p>8 come along, will it move from point B to the stream,</p> <p>9 which we'll call point C, and that's going to depend</p> <p>10 on a whole bunch of things. We talked about a lot 11:27:20</p> <p>11 of this yesterday with respect to the things that</p> <p>12 are associated with overland flow. So if the</p> <p>13 topography and the landscape factors and the cover</p> <p>14 and all the other things that mattered that we've</p> <p>15 talked about before, if those are different between 11:27:26</p> <p>16 B and C such that overland flow would not be</p> <p>17 contributed by that storm, then no, it wouldn't.</p> <p>18 But if the conditions were such that overland flow</p> <p>19 would be -- would allow movement from B to C, then</p> <p>20 perhaps it could. I have no -- I really have no way 11:28:06</p> <p>21 to know. It's a site specific kind of an issue.</p> <p>22 You can't make general conclusions about whether or</p> <p>23 not that would happen.</p> <p>24 <b>Q Are there areas within the Illinois River</b></p> <p>25 <b>watershed which have application of phosphorus to 11:28:16</b></p> <p style="text-align: center;">346</p>	<p>1 you know, the remain forever part. Being absolute</p> <p>2 with things is not really something that</p> <p>3 environmental science does, so I can't tell that you</p> <p>4 there are places where phosphorus is going to remain</p> <p>5 forever. I can't tell you that it's possible that 11:30:13</p> <p>6 there would be places that phosphorus would not</p> <p>7 remain forever. That's not really something that I</p> <p>8 can do with the information and the tools available</p> <p>9 to me.</p> <p>10 What I can do is to give you an indication 11:30:21</p> <p>11 of what's the relative likelihood of that movement,</p> <p>12 and that's what -- that's what the litter management</p> <p>13 approaches attempt to do in the case of litter. In</p> <p>14 the case of cattle, there are no regulations of</p> <p>15 which I'm aware that -- yet that attempt to do that 11:30:29</p> <p>16 and to regulate where that phosphorus and other</p> <p>17 things might be applied. There are regulations with</p> <p>18 respect to septic systems, and in many cases the</p> <p>19 septic systems are old and they were not installed</p> <p>20 under those regulations. 11:31:07</p> <p>21 <b>Q (By Ms. Burch) The -- in the event that there</b></p> <p>22 <b>is a place where you can land apply phosphorus and</b></p> <p>23 <b>it is not going to run off, are there places like</b></p> <p>24 <b>that in the Illinois River watershed?</b></p> <p>25 MR. BOND: Object to the form, asked and 11:31:16</p> <p style="text-align: center;">348</p>
<p>1 <b>the soil which never generate runoff of phosphorus?</b></p> <p>2 A I can't tell you that. I can't answer that.</p> <p>3 What I can say is that phosphorus in poultry litter,</p> <p>4 according to the rules that are in effect, is not</p> <p>5 placed in areas that would generate -- or be 11:29:02</p> <p>6 expected to generate an appreciable amount of</p> <p>7 overland flow. That's the reason that those areas</p> <p>8 are selected and the farmers are instructed to not</p> <p>9 apply phosphorus to those areas, and that's the</p> <p>10 reason why they will use things like phosphorus 11:29:11</p> <p>11 indices to try to decide the relative risk of</p> <p>12 phosphorus transport to avoid -- to avoid those</p> <p>13 areas.</p> <p>14 <b>Q And my question was more general than poultry</b></p> <p>15 <b>waste, and the question was, if phosphorus in the 11:29:18</b></p> <p>16 <b>form of animal waste or fertilizer or biosolids,</b></p> <p>17 <b>whatever the source, is applied to the surface of</b></p> <p>18 <b>the lands in the Illinois River watershed --</b></p> <p>19 A Uh-huh.</p> <p>20 <b>Q -- are there some locations within the 11:29:26</b></p> <p>21 <b>Illinois River watershed where that phosphorus will</b></p> <p>22 <b>be -- remain forever and not be transported via</b></p> <p>23 <b>runoff or infiltration?</b></p> <p>24 MR. BOND: Object to the form.</p> <p>25 A I'm not sure. We've discussed this before, 11:30:04</p> <p style="text-align: center;">347</p>	<p>1 answered.</p> <p>2 A There are places in the Illinois River</p> <p>3 watershed where one would not expect that there</p> <p>4 would be appreciable movement of phosphorus from</p> <p>5 that area to another area or, in particular, to a 11:31:22</p> <p>6 nearby stream. That's probably the majority of the</p> <p>7 land area, but I've not conducted analyses to try to</p> <p>8 determine that it's the majority of the land area,</p> <p>9 but that would be my general sense, that there are</p> <p>10 certain areas that have conditions such that one 11:32:03</p> <p>11 would expect that the opportunity for phosphorus to</p> <p>12 move is probably there, at least some portions of</p> <p>13 it, and that there would be an increased risk of</p> <p>14 phosphorus movement under storm conditions</p> <p>15 typically. And so there are conditions that are 11:32:11</p> <p>16 reasonably well understood and defined where you</p> <p>17 expect to find those areas, and then the other areas</p> <p>18 you expect to not find that situation.</p> <p>19 <b>Q (By Ms. Burch) And, you know, I just want to</b></p> <p>20 <b>make sure I understand. Is the answer yes, there 11:32:21</b></p> <p>21 <b>are areas where within the Illinois River watershed</b></p> <p>22 <b>that phosphorus will not be released in runoff?</b></p> <p>23 MR. BOND: Object.</p> <p>24 A I've not tried to determine if there are areas</p> <p>25 like that, and if so, where they are. What I can 11:32:29</p> <p style="text-align: center;">349</p>

TIMOTHY J. SULLIVAN, Ph.D., VOLUME II, 4-8-09

1 tell you is that, in general, there are certain  
 2 types of areas where you would expect that there's a  
 3 high risk or high possibility of phosphorus movement  
 4 to occur under storm conditions, and there are other  
 5 areas where you do not expect that there's a high 11:33:07  
 6 risk and an increased possibility of phosphorus  
 7 movement like that to occur, so that's clear. But  
 8 to say that it's impossible? Well, my response is  
 9 in environmental science, it's impossible for me to  
 10 say that it's impossible because the science doesn't 11:33:16  
 11 really allow me to do that.

12 **Q (By Ms. Burch) And I have the same question**  
 13 **in regard to fecal bacteria. Are there locations**  
 14 **within the Illinois River watershed where fecal**  
 15 **bacteria would not be released during runoff events 11:33:24**  
 16 **if it is present on the surface of the land?**

17 A My opinion is is that the situation would be  
 18 similar to phosphorus because it's largely the same  
 19 process that would mainly be expected to be  
 20 responsible for movement of fecal indicator bacteria 11:34:06  
 21 from a land setting to a stream. It's largely an  
 22 overland flow kind of an issue. As water  
 23 infiltrates through soil and if it moves laterally  
 24 through soil, this substantial opportunity,  
 25 depending on the soil type, but for the soil types 11:34:16

350

1 we have in the IRW, there's a substantial  
 2 opportunity for that bacteria to be adsorbed as soil  
 3 particles where eventually the bacteria will die.  
 4 And so the issue is, it's very similar to  
 5 phosphorus. It's the areas of the watershed that 11:34:24  
 6 generate overland flow. So in the case of bacteria,  
 7 in particular, it would include the areas that are  
 8 excluded from litter application by virtue of the  
 9 regulations to protect against overland flow, and  
 10 it's the compacted areas, it's the impervious areas 11:35:06  
 11 such as in the urban regions. Those are the areas  
 12 where -- kinds of areas where you would expect there  
 13 to be an increased risk of overland flow and,  
 14 therefore, a potential transport of bacteria.

15 **Q And my question wasn't -- was not directed 11:35:17**  
 16 **towards identifying areas of higher risk of overland**  
 17 **flow. My question was, are there areas within the**  
 18 **Illinois River watershed that will not generate**  
 19 **fecal bacteria in runoff if that fecal bacteria is**  
 20 **present on the surface of the land? 11:35:28**

21 A Well, again, I can't be that dogmatic about  
 22 the issue because the tools of environmental science  
 23 don't allow me to do that. I can't say that it's  
 24 impossible, you know, that the phosphorus could move  
 25 from any area. What I can say is that based on the 11:36:07

351

1 science, that my interpretation is that there are  
 2 certain areas where there's an increased likelihood  
 3 and there's certain areas where there is not. And  
 4 so if someone is concerned about managing the  
 5 movement of fecal indicator bacteria into a stream, 11:36:16  
 6 then you look at the areas where there's an  
 7 increased opportunity for that kind of overland flow  
 8 pathway to occur.

9 **Q Just so I understand, and what do you mean by**  
 10 **increased opportunity? 11:36:26**

11 A Well, if it's an area where you expect there  
 12 to be the possibility of overland flow, then if the  
 13 overland flow occurs, then there's an increased  
 14 chance that bacteria can be transported with it. If  
 15 the rainfall results in infiltration into the soil 11:37:05  
 16 and then lateral movement in the soil -- within the  
 17 soil or moving down into the groundwater, then in  
 18 the process of going through that soil, there's a  
 19 greatly increased opportunity for those bacteria to  
 20 be adsorbed, particularly if you don't have sandy 11:37:12  
 21 soils, which in the IRW, for the most part, you  
 22 don't. So where the water flows, just like for  
 23 phosphorus, bacteria -- fecal indicator bacteria,  
 24 it's very important because of overland flow, and  
 25 there's an increased possibility of movement, which 11:37:23

352

1 may end up in the stream. But if it's not overland  
 2 flow but rather is infiltration and base flow kinds  
 3 of flow paths, then it's unlikely that the bacteria  
 4 would move into a stream, but the tools don't allow  
 5 me to say that something is impossible. 11:37:32

6 **Q Have you ever reviewed any research that was**  
 7 **conducted in the Illinois River watershed related to**  
 8 **the likelihood of overland flow or infiltration**  
 9 **given the soil types in the watershed?**

10 A That would have been part of some of these 11:38:09  
 11 studies that focused on phosphorus indices. I don't  
 12 think I can point you to a particular study, but I'm  
 13 not saying that there isn't one out there. There  
 14 may very well be something out that certainly  
 15 touches on that. I'm not aware of any kind of a 11:38:20  
 16 definitive study.

17 **Q Do you know whether any critical source areas**  
 18 **have been identified in the Illinois River**  
 19 **watershed?**

20 A Well, I would -- I don't know if within the 11:38:28  
 21 context of doing the -- of conducting the phosphorus  
 22 index calculations in conjunction with the nutrient  
 23 management plans, that the people actually label  
 24 them as such, but that -- that knowledge or that  
 25 understanding of how systems work is embedded in 11:39:11

353

TIMOTHY J. SULLIVAN, Ph.D., VOLUME II, 4-8-09

<p>1 statement.</p> <p>2 <b>Q (By Ms. Burch) Well, have you reviewed the</b></p> <p>3 <b>Arkansas Department of Environmental Quality 2000</b></p> <p>4 <b>report?</b></p> <p>5 A The Arkansas Department of Environmental 03:28:14</p> <p>6 Quality 2000 report --</p> <p>7 <b>Q That's cited as the basis for this statement.</b></p> <p>8 A I -- was it in my considered materials?</p> <p>9 <b>Q I don't -- I honestly don't know. I didn't</b></p> <p>10 <b>memorize it. 03:28:22</b></p> <p>11 A I mean, if I reviewed it, it would be in my</p> <p>12 considered materials. But again, I mean just even</p> <p>13 if -- even if that's what that report says is --</p> <p>14 because my investigations have led me to believe</p> <p>15 that there are no data available with which to 03:28:28</p> <p>16 evaluate that question, is it I wouldn't believe</p> <p>17 what anybody said along those lines until I saw the</p> <p>18 data that they used from which to draw such a</p> <p>19 conclusion. It's very difficult to collect such</p> <p>20 data because it's all mixed together. It's 03:29:06</p> <p>21 different kinds of fertilizer applications, it's the</p> <p>22 animals, it's the erosion associated with the</p> <p>23 animals' activities, septic systems, because the</p> <p>24 farmers live next door to the field, it's the road</p> <p>25 erosion, I mean, it's all mixed together. It's 03:29:14</p> <p style="text-align: center;">466</p>	<p>1 soil between the plants oftentimes, which is very</p> <p>2 prone to erosion and carrying phosphorus with it,</p> <p>3 and very much more prone to overland flow as a</p> <p>4 consequence of not being vegetated.</p> <p>5 And then in addition to the agricultural 03:31:08</p> <p>6 lands, you also have livestock of many different</p> <p>7 types and their activities that we've discussed</p> <p>8 multiple times here in this deposition, and you</p> <p>9 often times have a much higher density of roads and</p> <p>10 road culverts, road and stream crossings that are 03:31:16</p> <p>11 prone to erosion. You have -- in the agricultural</p> <p>12 lands, you have people living there with septic</p> <p>13 systems and pets and lawns, lawn fertilizer, so</p> <p>14 there tends to be a lot more human activity in the</p> <p>15 agricultural lands. That's not always the case, but 03:31:26</p> <p>16 it's usually the case, and in addition, you have all</p> <p>17 of these additional sources that are much more</p> <p>18 likely to be important to the agricultural lands and</p> <p>19 are generally not important to the forested lands so</p> <p>20 that finding is a very common finding that 03:32:05</p> <p>21 concentrations of the various nutrients tend to be</p> <p>22 much lower in forested settings than they do in all</p> <p>23 other settings, essentially.</p> <p>24 <b>Q Did you evaluate some phosphorus concentration</b></p> <p>25 <b>information in Lake Tenkiller? 03:32:13</b></p> <p style="text-align: center;">468</p>
<p>1 very, very difficult to design and conduct a study</p> <p>2 that would tell you specifically what's coming off</p> <p>3 of the pastures that were fertilized with any</p> <p>4 particular source and not otherwise impacted by some</p> <p>5 other particular source. I don't believe that such 03:29:22</p> <p>6 data exists in the IRW. If they exist, I'd like to</p> <p>7 see them. But again, I would not agree to such a</p> <p>8 statement without seeing what it's based upon.</p> <p>9 <b>Q Do you agree that phosphorus concentrations in</b></p> <p>10 <b>Ozark streams are typically greater in streams 03:30:02</b></p> <p>11 <b>draining agricultural lands than in those draining</b></p> <p>12 <b>forestlands?</b></p> <p>13 A I would agree that that would likely be true.</p> <p>14 I'm not sure I've seen the data to substantiate</p> <p>15 that, but I would certainly expect that to be true. 03:30:11</p> <p>16 <b>Q Why is that?</b></p> <p>17 A Well, in forested lands, many of the potential</p> <p>18 sources that you have in agricultural lands are</p> <p>19 either not there or they're there in much lesser</p> <p>20 intensity. Sources of phosphorus in forested lands 03:30:19</p> <p>21 are mostly related to -- to erosion. Wildlife can</p> <p>22 play a role, but it's mostly related to erosion.</p> <p>23 In agricultural lands, you can have row</p> <p>24 crop activities that contribute oftentimes very</p> <p>25 large amounts of phosphorus because there's bare 03:31:02</p> <p style="text-align: center;">467</p>	<p>1 A Did I?</p> <p>2 <b>Q Yes.</b></p> <p>3 A I looked at -- I didn't do a lot with Lake</p> <p>4 Tenkiller. I looked at phosphorus concentrations in</p> <p>5 Lake Tenkiller relative to a survey of reservoirs in 03:32:20</p> <p>6 Missouri, and I looked at data from Doctors Cooke</p> <p>7 and Welch, from their expert report for the State in</p> <p>8 this case with respect to potential changes in total</p> <p>9 phosphorus concentrations in Lake Tenkiller over</p> <p>10 time, and how they may be related or not related to 03:32:32</p> <p>11 the changes in the amount of stream flow that we</p> <p>12 just discussed as being important a few minutes ago,</p> <p>13 so I looked at those. I don't remember any other</p> <p>14 issues I looked at with respect to Tenkiller. That</p> <p>15 was mainly -- Tenkiller was mainly covered by 03:33:08</p> <p>16 defendants' experts Horne and Conley.</p> <p>17 <b>Q Is your analysis of the Lake Tenkiller data</b></p> <p>18 <b>that you did look at on Page 35 of your report? I</b></p> <p>19 <b>don't think it is. It's not. It's not. I'll give</b></p> <p>20 <b>you a better cite. Let's try Page 91 of your 03:33:26</b></p> <p>21 <b>report.</b></p> <p>22 A Okay.</p> <p>23 <b>Q Is that at least where the analysis of the</b></p> <p>24 <b>Lake Tenkiller data begins in your report?</b></p> <p>25 A I think it is. Let's see, I think it begins 03:34:19</p> <p style="text-align: center;">469</p>

TIMOTHY J. SULLIVAN, Ph.D., VOLUME II, 4-8-09

1 at the top of Page 91. I mean, I'd have to look  
 2 carefully to see if there was some discussions  
 3 somewhere else, but I don't think that there is.  
 4 Q That's fine. In the first full paragraph of  
 5 that report, you indicate that you are analyzing the 03:35:02  
 6 concentrations of total P at the lacustrine lake  
 7 like sampling stations, Lake 1 and Lake 2 in Lake  
 8 Tenkiller; is that correct?  
 9 A I certainly discussed those, yes, but I think  
 10 that the figure actually shows Lake 1. But yes, I 03:35:12  
 11 discussed the two that are identified by the State,  
 12 and properly so, as lacustrine or Lake 1 and Lake 2.  
 13 Q Okay. Did you present your analysis of the  
 14 total phosphorus data for Lake 2?  
 15 A I don't think I showed Lake 2 anywhere. No, I 03:35:23  
 16 focused on Lake 1.  
 17 Q Did you do an analysis of the phosphorus  
 18 concentrations in Lake 2?  
 19 A No.  
 20 Q Why not? 03:35:32  
 21 A Well, the Lake 1 sample is a sample at the  
 22 site that's identified as the site closest to the  
 23 dam that's in a reservoir, that's typically the  
 24 deepest location in the reservoir. When lakes and  
 25 reservoirs -- a reservoir is actually a type of a 03:36:11

470

1 lake, but lakes are characterized with respect to  
 2 the water chemistry, that the site that's generally  
 3 selected with which to characterize the lake is the  
 4 deepest site, and in reservoirs, that tends to be  
 5 quite close to the dam. And that's why in the 03:36:19  
 6 Missouri study that I include on that figure, that's  
 7 the way that study was conducted, it's all one site  
 8 close to the dam where we're comparing apples with  
 9 apples. When the EPA conducts lake surveys like the  
 10 National Lake Survey from 2007 or the environmental 03:36:28  
 11 monitoring assessment program lake surveys that have  
 12 been going on since the early '90s, when the EPA or  
 13 even the National Rain -- the U.S. National Rain  
 14 Program, the lake survey that was conducted in  
 15 that -- actually there were two of them, the eastern 03:37:09  
 16 and the western lake surveys in the '80s, all of  
 17 those are done based on one sample and what is  
 18 determined to be the likely deepest part of the  
 19 lake, that's usually how it's done. It doesn't mean  
 20 that other locations are not also relevant, they 03:37:17  
 21 are, but if you want to characterize a lake, you  
 22 want to pick a site to characterize the lake, you  
 23 pick the deepest site and reservoir that's closest  
 24 to the dam, so that's why I chose Lake 1. I could  
 25 have done an analysis on Lake 2, but that's why I 03:37:24

471

1 chose Lake 1.  
 2 Q Did you do an analysis on Lake 3 or Lake 4?  
 3 A No. I looked at data on Lake 3 and 4 and  
 4 Cooke and Welch, but I did not do analysis on Lakes  
 5 3 and 4. 03:38:02  
 6 Q Do you know how the State of Oklahoma requires  
 7 lakes to be analyzed for water quality?  
 8 A No.  
 9 Q Do you know how the State of Oklahoma  
 10 typically evaluates water quality in lakes with 03:38:12  
 11 reference to sampling locations?  
 12 A No.  
 13 Q Number of samples?  
 14 A I don't know what the State of Oklahoma  
 15 generally does with regard to that, no. I mean, 03:38:17  
 16 I've seen data from lakes from Oklahoma, for  
 17 example, I think some of that might have been in --  
 18 well, maybe not. Maybe I haven't. I'm not sure.  
 19 Q Do you think that the sampling data at Lake 4  
 20 would represent accurately the water quality 03:38:29  
 21 conditions at, say, Lake 2?  
 22 A No. No, they are very, very different.  
 23 Q And I assume your answer would be the same  
 24 with regard to Lake 3 and Lake 4?  
 25 A The sites are chosen because they're intended 03:39:12

472

1 to represent physical portions of the reservoir.  
 2 They're intended to be different, and they are  
 3 different.  
 4 Q So do you know whether in the physical portion  
 5 of Lake Tenkiller represented by lake sampling 03:39:29  
 6 station 2 conditions are better or worse over time?  
 7 A Well, Lake 2 is the transitional part or was  
 8 identified in the sampling program as the  
 9 transitional part, so it's the transition from being  
 10 a river like portion of the lake to a lake like 03:40:08  
 11 portion of the lake, that's what riverine and  
 12 lacustrine mean. Riverine is river like.  
 13 Lacustrine is lake like. The transitional zone is  
 14 the attempt on the part of the people who collected  
 15 the samples to identify where they think that 03:40:16  
 16 transition is most likely occurring from being more  
 17 like a river to being more like a lake. And the  
 18 concentrations of different constituents at that  
 19 location are going to be different than they are --  
 20 typically they're going to be different than they 03:40:25  
 21 are in the lake like part of the lake and also  
 22 different than they are in the river like part of  
 23 the lake because it's a transitional zone. Things  
 24 are different there.  
 25 Q Do you know whether conditions at Lake 2 03:41:03

473

**TIMOTHY J. SULLIVAN, Ph.D., VOLUME II, 4-8-09**

<p>1 beyond what's in those reports, the general feeling                  2 on reservoirs is the deepest part is closest to the                  3 dam. That would not be something that I could                  4 necessarily derive from EPA because when EPA                  5 samples, they're sample lakes that include 03:47:03                  6 reservoirs. Reservoirs is a type of lake. Some                  7 people say lakes and reservoirs, but reservoirs are                  8 a hydrological type of lake. And when EPA samples                  9 lakes of all types, their sampling scheme for these                  10 sites that they use to characterize the lake would 03:47:11                  11 be the deepest points. Sometimes there are studies                  12 that include some sampling at other locations, as                  13 well, from the littoral zones, to get at biological                  14 components, littoral samples, but the site that they                  15 use to characterize a lake across the board with 03:47:19                  16 their surveys is a site at the deepest part of the                  17 lake.                  18 <b>Q Is that true with regard to -- without regard                  19 to the purpose of the sampling?</b>                  20 <b>A Well, these are -- EPA does a lot of large 03:47:25</b>                  21 statistical surveys. That's where they select their                  22 sites as random and they sample them once, and then                  23 they use that to characterize the resource across                  24 the region, across the state, across the nation.                  25 They are statistically based so results can be 03:48:04</p> <p style="text-align: center;">478</p>	<p>1 <b>Q Did you -- in discussing any improvement in                  2 the quality of Lake Tenkiller, did you do any                  3 analysis of AHODS?</b>                  4 <b>A Analysis of what? 03:49:32</b>                  5 <b>Q AHODS.</b>                  6 <b>A What's that?</b>                  7 <b>Q That's okay, I guess you didn't.</b>                  8 <b>A I have no idea what you said. Is that a crow                  9 hoglet, with some kind of an accent from Oklahoma.</b>                  10 <b>Q It's a Missouri accent. A-H-O-D-S? 03:50:07</b>                  11 <b>A Okay. I've seen reference to that in other                  12 reports. It's not something I know anything about.</b>                  13 <b>Q Did you do any analysis in determining whether                  14 or not Lake Tenkiller had improved or not improved                  15 of chlorophyll a values? 03:50:16</b>                  16 <b>A No, I did not.</b>                  17 <b>Q Any other parameters besides total phosphorus?</b>                  18 <b>A No.</b>                  19 <b>Q Do you know whether Dr. Stevenson in his work                  20 in the Illinois River looked at any parameters other 03:50:26</b>                  21 than total phosphorus when evaluating the impact,                  22 eutrophication impacts in the Illinois River                  23 watershed?                  24 <b>A Dr. Stevenson looked at a number of                  25 parameters. The focus of my report is primarily on 03:51:06</b></p> <p style="text-align: center;">480</p>
<p>1 extrapolated from the individual lakes to larger                  2 areas, be a region or a state or nation. Depending                  3 on the statistical foundation of the survey, they'll                  4 have the ability to extrapolate to different levels                  5 of geography. That's what they do. They've done a 03:48:12                  6 lot of those. Again, the most recent one was                  7 conducted in 2007. The database just got finalized                  8 a few weeks ago. I'll be working with those data                  9 doing some analyses in the near future, and that                  10 will be coming out in a report in various 03:48:22                  11 publications over the next several years.                  12 <b>Q So I guess -- I understand what you're saying                  13 in the context of surveys. In site specific studies                  14 of lakes evaluating eutrophication, is it EPA's                  15 practice to only look at one sampling site in the 03:49:04</b>                  16 deepest part of a lake or reservoir?                  17 <b>A My suspicion is you're probably going to see                  18 the whole gamut from studies that sample at lots of                  19 sites to studies that sample at one site. I mean,                  20 beyond -- I can't tell you for sure, but that's my 03:49:12</b>                  21 suspicion.                  22 <b>Q Do you know how many sampling sites there were                  23 in the EPA Clean Lake Study of Lake Tenkiller?</b>                  24 <b>A I know there were multiple sites. I don't                  25 remember how many there were. 03:49:19</b></p> <p style="text-align: center;">479</p>	<p>1 total phosphorus, secondarily on fecal indicator                  2 bacteria, so I didn't really go into the other                  3 parameters that Dr. Stevenson looked at in his                  4 study, but I do remember from reading it that he                  5 did -- he looked at a number of other parameters 03:51:16                  6 besides total phosphorus.                  7 <b>Q Do you recall what any of those were?</b>                  8 <b>A I know he looked at dissolved oxygen. I                  9 really don't remember what the other factors were                  10 because, I mean, when I read it, I knew I wasn't 03:51:25</b>                  11 focusing on those, and so I mean I can speculate,                  12 but I don't remember with certainty which the other                  13 parameters were that he studied.                  14 <b>Q On Page 92 of your report, you quote Cooke and                  15 Welch for the proposition that they say P 03:52:13</b>                  16 concentrations and chlorophyll are high and                  17 increasing?                  18 <b>A Uh-huh, yes.</b>                  19 <b>Q Is that a complete quote?</b>                  20 <b>A Well, the three dots before it and the three 03:52:20</b>                  21 dots after it indicate that's not a complete quote,                  22 that's what they said.                  23 <b>Q Do you know if they might have been                  24 referencing other sampling sites besides Lake 1?</b>                  25 <b>A I don't remember that they were particularly 03:53:01</b></p> <p style="text-align: center;">481</p>

TIMOTHY J. SULLIVAN, Ph.D., VOLUME II, 4-8-09

<p>1 And looking at previous assessments, we  2 talked about Haraughty before, so I'll point to that  3 one. Haraughty talked about many, many sources as  4 being potentially important and in need of  5 investigation and/or remediation and they were 04:12:11  6 basically ignored, or if they weren't ignored, they  7 were inappropriately diminished in importance. And  8 I'll give you an example of inappropriately  9 diminished. For example, Dr. Engel, in his  10 modeling, he -- he made assumptions about how many 04:12:20  11 cattle have access to streams, and he deleted off  12 the top all of his first and second order streams.  13 Well, that's 80 percent of the streams in the IRW  14 are first and second order streams, so he deleted 80  15 percent of the streams, and then he said the 04:12:29  16 remaining 20 percent, that they are 40 to 50 percent  17 fenced based on one person told him. I mean, that's  18 not scientifically valid, that's ridiculous. So  19 that's an extreme example of some of the ways in  20 which the other potential sources were discounted, 04:13:08  21 and there are lots of others in the report and  22 they're all in there. I probably don't have to  23 highlight them at this point.  24 <b>Q Have you ever done a GLEAMS model?</b>  25 A Have I run GLEAMS? 04:13:15</p> <p style="text-align: center;">494</p>	<p>1 A Yes, they include hydrology components, all  2 the ones I mentioned include hydrology and surface  3 water chemistry components to them.  4 <b>Q Okay. Are they used for assessing the impact  5 of phosphorus on the environment? 04:15:04</b>  6 A No, although phosphorus is in the ILWAS, I'm  7 pretty sure. And the other one that I'm having  8 trouble with the name -- NuCM, sorry, N-u-C-M, the U  9 is lower case, everything else is a capital. I'm  10 pretty sure phosphorus is in NuCM, and I'm fairly 04:15:16  11 sure phosphorus is in ILWAS, but it is not in  12 PeNet-PGC, I'm thinking, and it is definitely not in  13 MAGIC.  14 <b>Q Are they ever used to assess the impacts of  15 phosphorus transport from agricultural lands? 04:15:23</b>  16 A No.  17 <b>Q The question I had about Page 50 was you say  18 that the plaintiffs' claims don't agree -- claims  19 regarding land application of poultry litter  20 constituting the primary source don't agree with the 04:16:01  21 results of previous assessment? What previous  22 assessment are you referencing?</b>  23 A Well, mainly I'm referencing Haraughty, but  24 there was another one, I think that's the same  25 quote, and I would have to go back and check to be 04:16:09</p> <p style="text-align: center;">496</p>
<p>1 <b>Q Uh-huh.</b>  2 A No.  3 <b>Q Have you ever done a model like Dr. Engel did  4 in this case?</b>  5 A I've run a number -- well, I have conducted 04:13:20  6 studies where we ran a number of watershed models  7 and published many, many of those studies based on  8 the results of watershed modeling, but GLEAMS or  9 GLEAMS like would not be any of the models that I  10 have published on. 04:13:29  11 <b>Q And the types of models that you have  12 experience running in watersheds would be described  13 in your CV?</b>  14 A Not necessarily, no. Do you want me to list  15 them for that, make a -- 04:14:05  16 <b>Q Sure, yeah.</b>  17 A MAGIC, all capitals; PeNET-PGC, capital P,  18 lower case E, and then all capitals, N-E-T - P-G-C;  19 ILWAS, I-L-W-A-S, all capitals; MAGIC, PeNet,  20 ILWAS -- mental block, there's another. I'm sorry, 04:14:18  21 I can't remember. I can't remember the name.  22 There's one other large model that I've published  23 on, but anyway, none of them are like GLEAMS.  24 <b>Q Are any of them hydrologic surface water  25 quality models? 04:14:27</b></p> <p style="text-align: center;">495</p>	<p>1 sure, but the Oklahoma Scenic Rivers Commission,  2 Oklahoma State University, National Park Service,  3 1999 Illinois River Management Plan, I believe that  4 you get the same -- the same flavor from that  5 assessment. 04:16:19  6 MR. BOND: It's 4:15.  7 MS. BURCH: Two more questions, really  8 quick.  9 <b>Q (By Ms. Burch) Have you ever done a mass  10 balance analysis for nutrients in a watershed? 04:16:24</b>  11 A No.  12 <b>Q Have you ever conducted a principal component  13 analysis?</b>  14 A Yes. Well, yes, yes.  15 <b>Q Have you conducted a principal component 04:16:32  16 analysis with regard to identifying sources of  17 pollution?</b>  18 A Not that I can remember.  19 MS. BURCH: Okay. No further questions.  20 THE WITNESS: Thank you. 04:17:09  21 MR. BOND: I don't have any questions, and  22 he'll read and sign.  23 VIDEOGRAPHER: We are now off the record.  24 The time is 4:17 p.m.  25</p> <p style="text-align: center;">497</p>